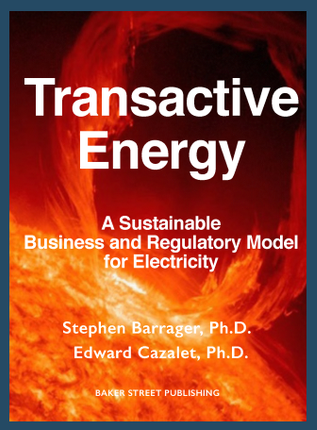
Transactive Energy

A Sustainable Business and Regulatory Model for Electricity

Environmental Energy Technology Division Seminar

Lawrence Berkely National Laboratory

June 22, 2014



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Transactive Energy has four big ideas.

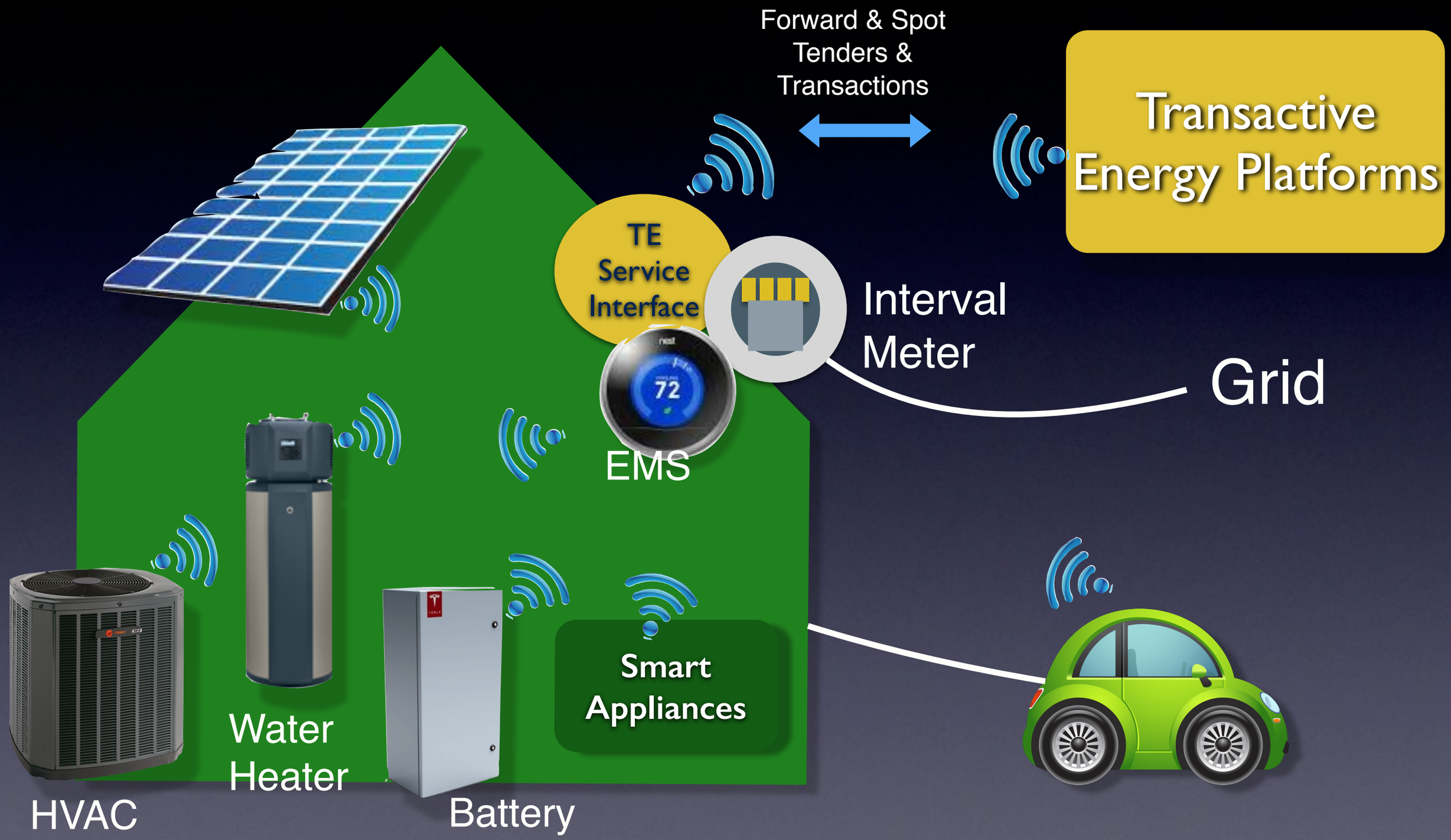
Forward transactions are used to coordinate investments and manage risk.

Spot transactions are used to coordinate operating decisions.

All parties act autonomously.

There are two products: energy and transport.

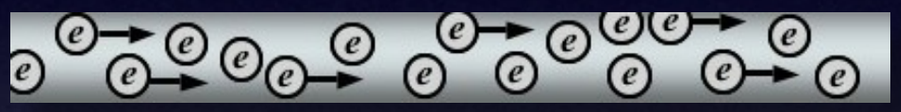
A fully-equipped home (or business) looks like this in the Transactive Energy (TE) model.



The TE business process is straightforward. There are tenders and transactions. There are two kinds: "forward" and "spot."

The Transport product delivers the Energy product.

Electric energy (produced at a place and time)



Transport

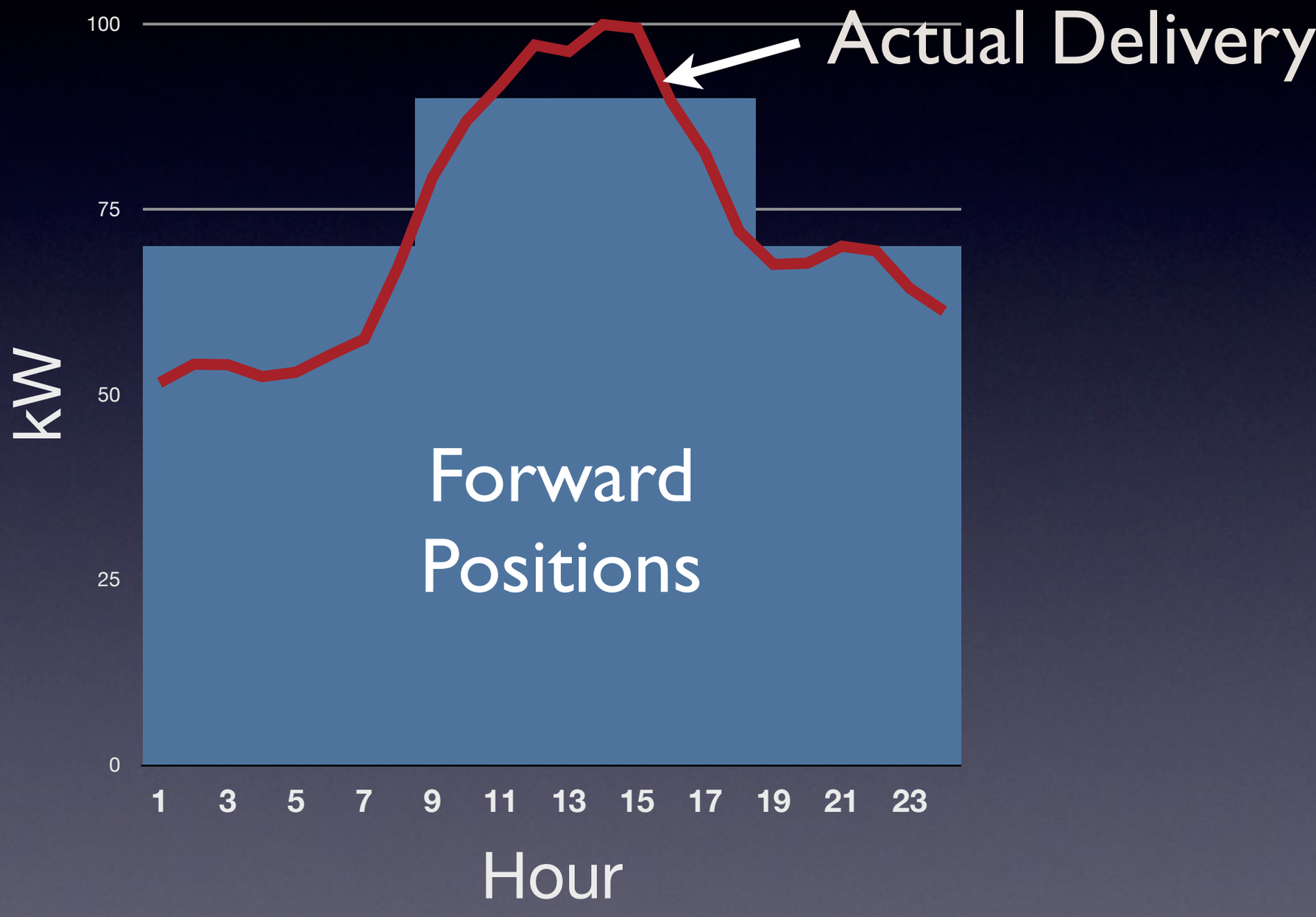
Electric energy (delivered at a different place and same time)

Here's an example of how TE works for a consumer.

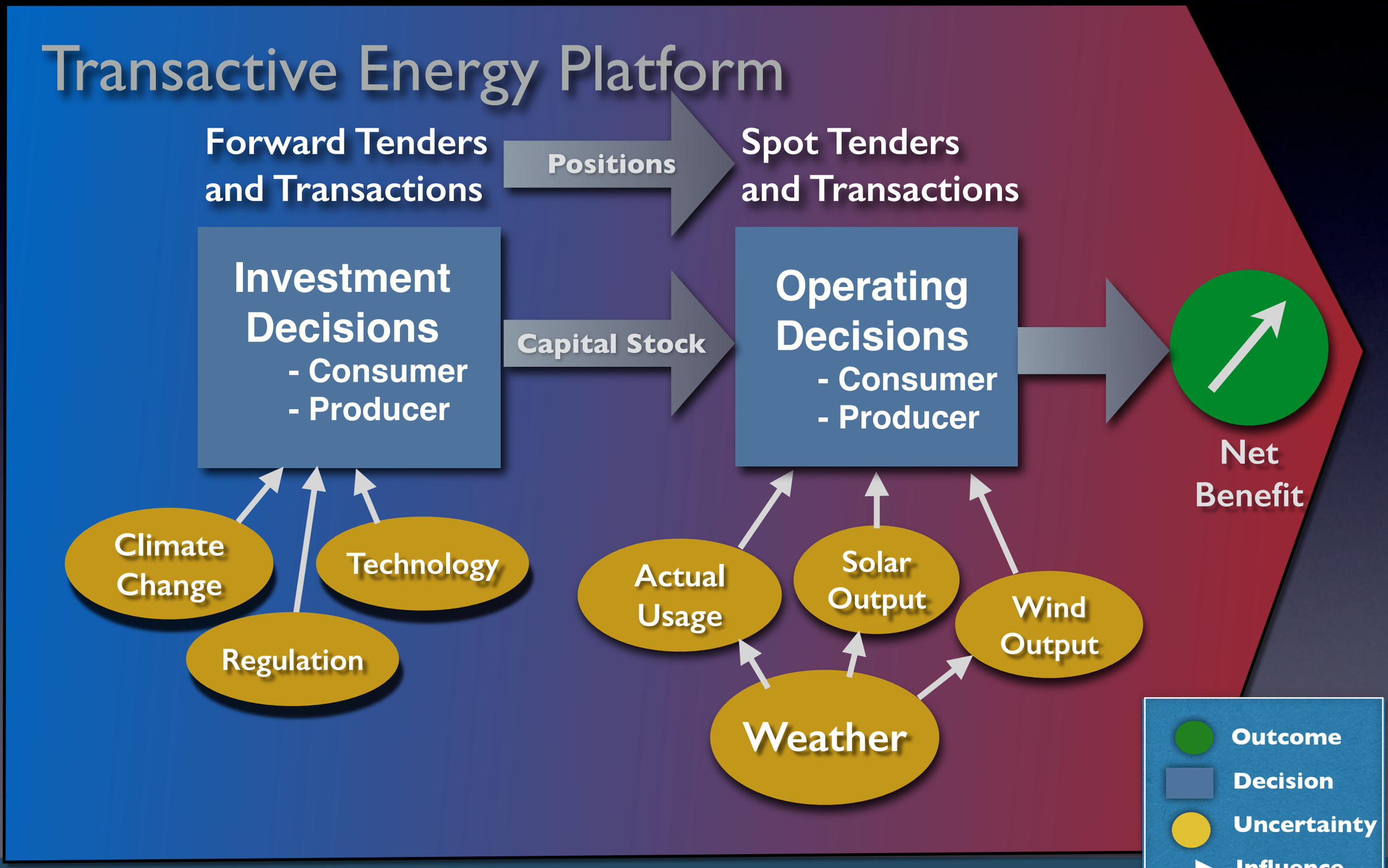
- Based on my typical usage, I automatically transact with one or more suppliers for delivery of a fixed quantity of energy in each hour of the year(s) for a fixed monthly payment (subscription.)
  - If I use less than I subscribed for in each hour then I am paid for the difference at an hourly spot price.
  - If I use more than I subscribed for then I pay for the difference at an hourly spot price.
  - At any time I can automatically buy or sell a quantity of energy at current tendered prices.

My energy management system (EMS) automates this process for both energy and transport.

Spot market transactions are used to buy or sell the difference between forward positions and actual delivery.



Forward tenders and transactions coordinate investment decisions.
Spot tenders and transactions coordinate operating decisions.



Parties interact on independent TE platforms with oversight.

Grid Custodians:
Congress, DOE, EPA, FERC, NERC, Legislatures, PUCs, Munis, CCAs, PMAs, Coops

Energy Services Parties
- Consumers
- Producers
- Prosumers
- Storage Owners

Transport Services Parties
-Transmission Operators (TO)
- Distribution Operators (DO)

Transaction Platform Providers

Tender and Transaction Data Bases

Intermediaries
- Exchanges
- Marketers
- Retailers
- System Operators

TE Service Interface

Tenders and Transactions

Parties use a TE Service Interface to control devices/systems and manage tenders and transactions.

Energy in/out

Devices and Systems

Device State

Control Signals

Weather forecasts

Objectives

Management Algorithms (EMS)

Benefit

TE Service Interface

Tenders

Transactions

Transaction Platforms

Standards and protocols support commerce.

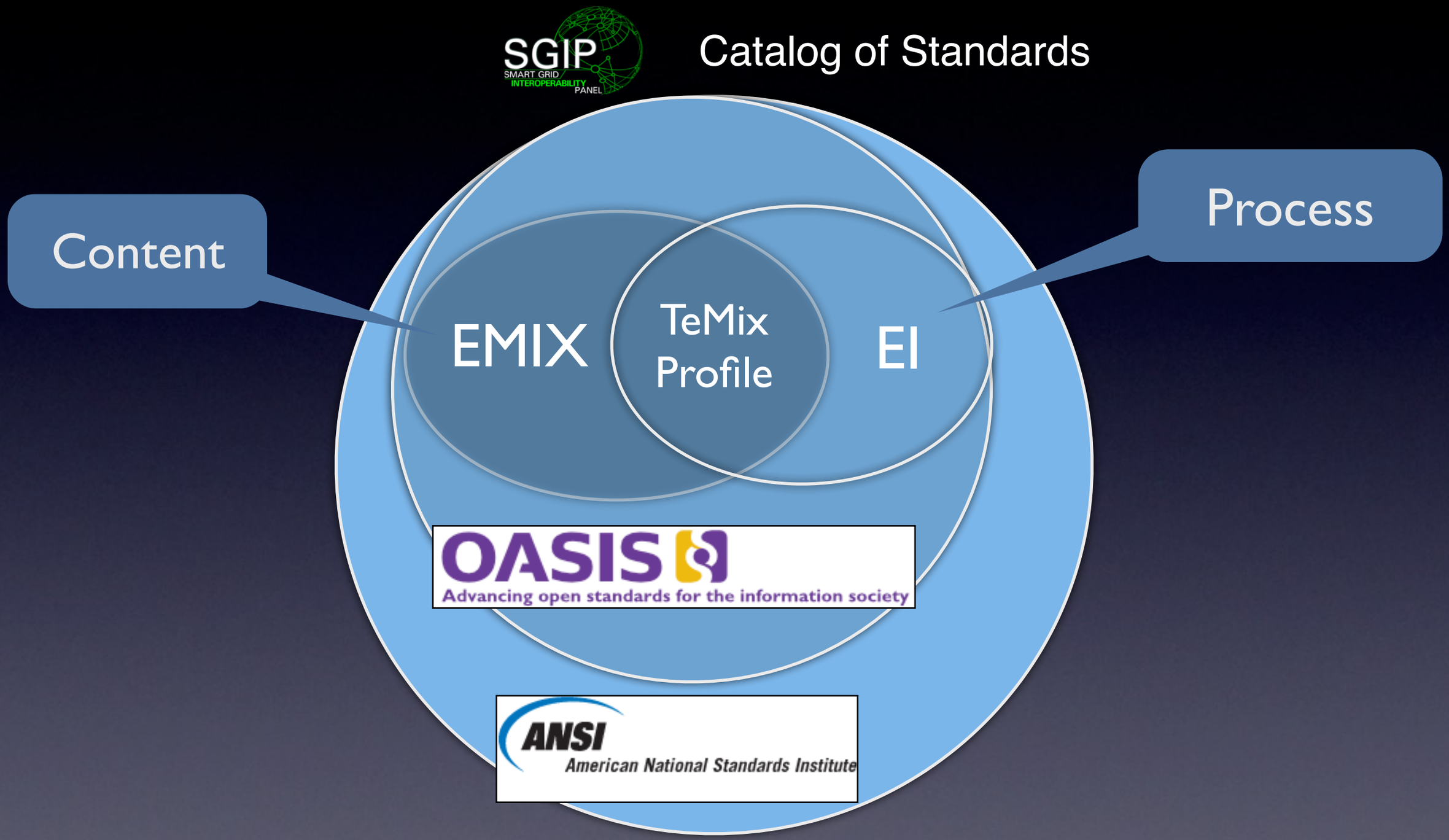
TeMix Protocol
Electric energy and transport transactions

High volume, high speed Standards

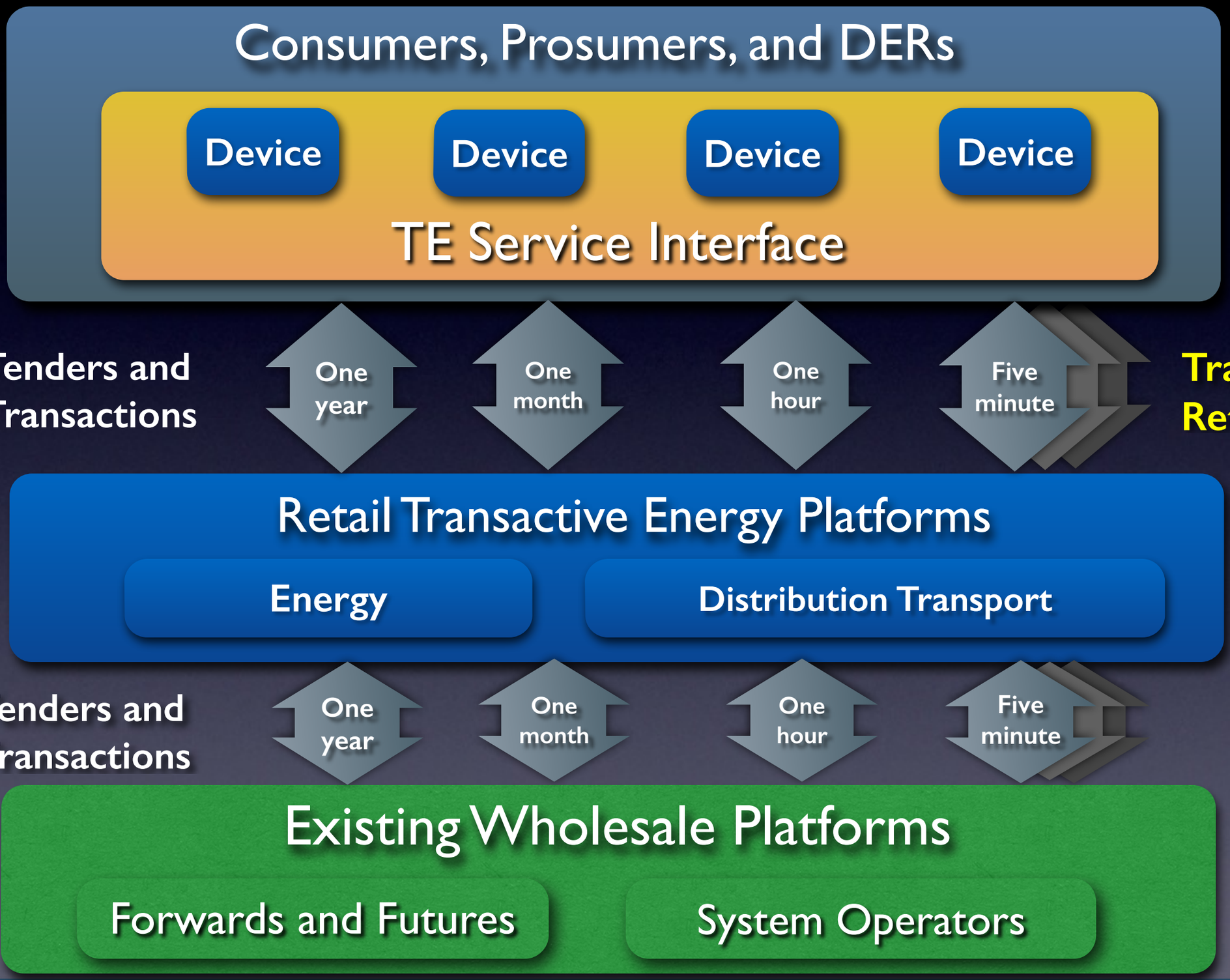
Internet Protocol (TCP/IP)
Data Transfers

FIX Protocol
Financial Transactions

The "open and free" TeMix protocol covers the required process and content.



Transactive Energy can be incrementally deployed to work with current systems and entities.



Transactive Energy is a "Silver Bullet."

- It will spur innovation.
- It is fair and transparent.
- It will provide incentives for efficiency.
- It addresses many vexing problems:
  - renewables,
  - net metering,
  - investment, reliability and fixed costs,
  - price responsive demand,
  - decentralized generation, storage and microgrids,
  - wholesale/retail coordination, and
  - regulatory.

The TE rollout process for California.

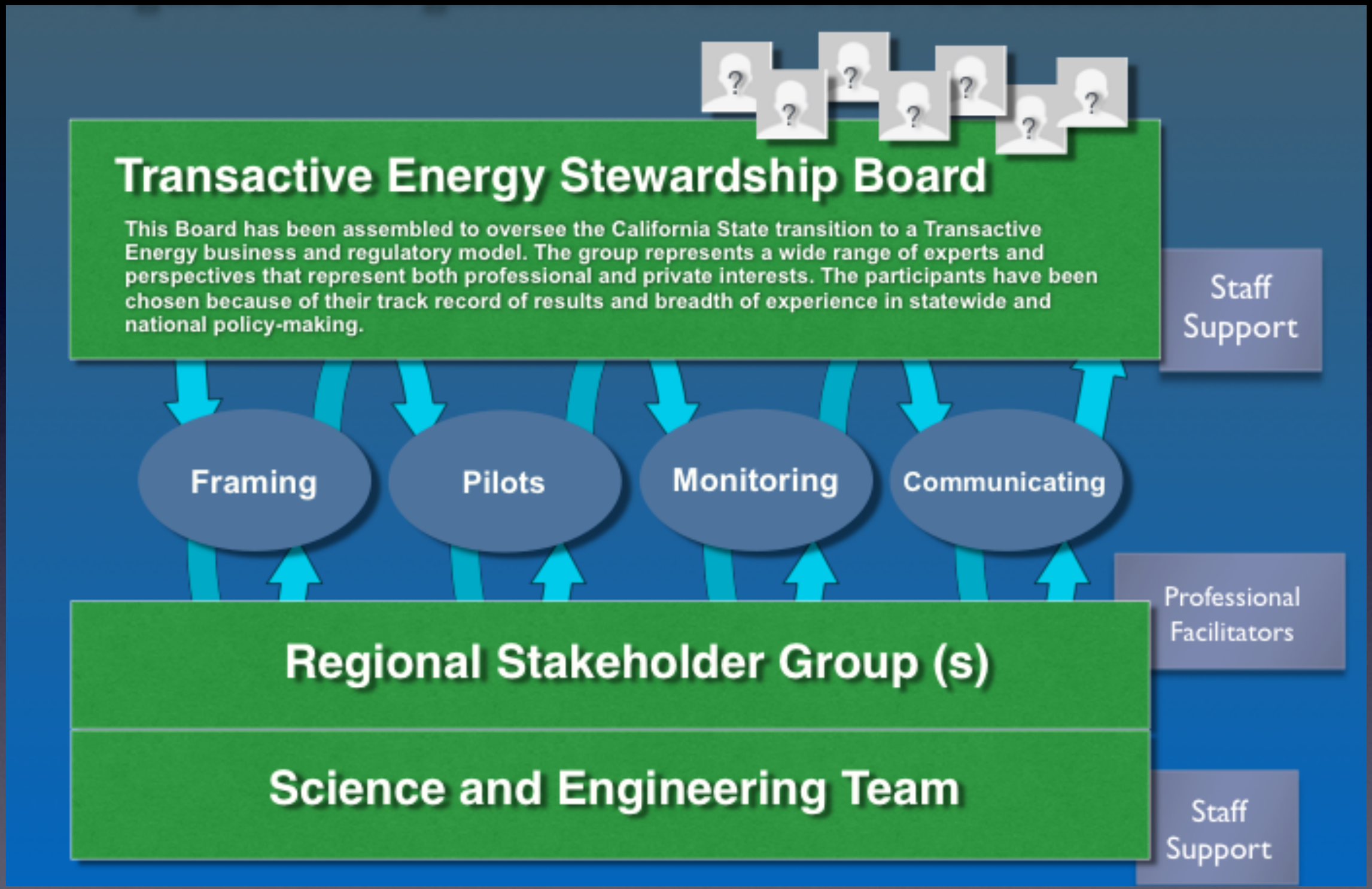
Transactive Energy pilots

Pilot Monitoring

Enabling Legislation

Stewardship Council

Organization Chart for the TE Initiative



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Visit TEA for continuing open discussion of Transactive Energy :

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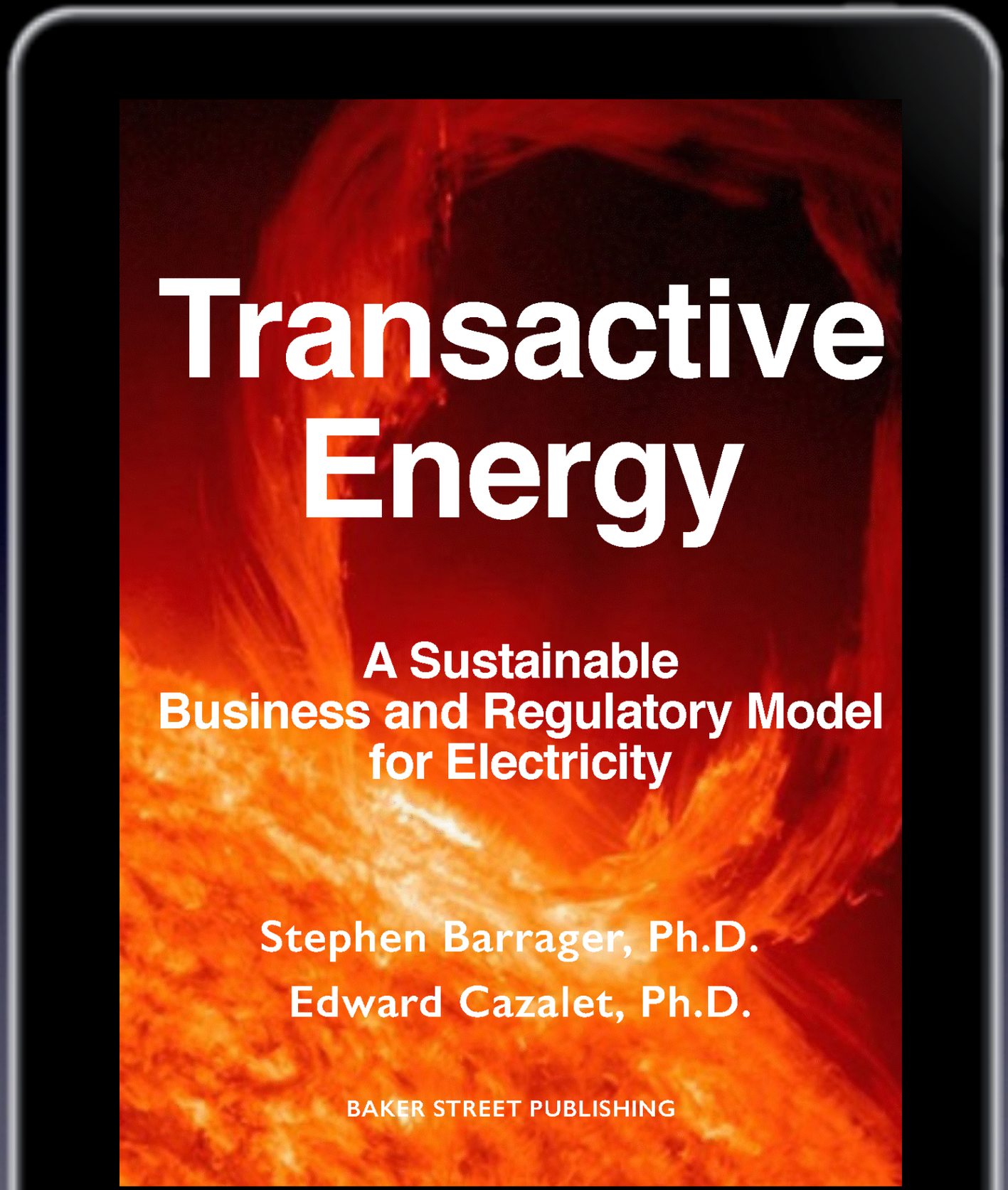

Available on the Apple iBook Store.